Summary of results from switchgrass co-firing testing at the Ottumwa Generating Station

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After several years of planning, the Chariton Valley RC&D and Alliant Energy successfully completed the first large-scale switchgrass co-firing test at the Ottumwa Generating Station in Chillicothe, Iowa. The National Renewable Energy Laboratory provided onsite startup support and testing coordination for the first of several planned co-fire tests.

Over 1,200 tons of switchgrass (*Panicum virgatum*) were burned over a two-month period at rates up to 16 tons/hour (14.5 m.t./hr). Modifications and improvements to the switchgrass handling equipment increased the throughput from a meager 2 tons/hour (1.8 m.t./hr) initially to sustainable rates well above the 12.5 ton/hour (11 m.t./hr) project goal. Data and samples were collected to determine the effect of the switchgrass on such items as the boiler efficiency, combustion controls, and environmental emissions. Baseline and co-fire stack testing was conducted, along with periodic flue-gas sampling. Fuel and ash samples were collected from several locations in the boiler house to compare the ash from the coal with the ash collected during co-firing.

Ottumwa Generating Station is a 725 MW tangentially-fired, pulverized coal boiler. The coal feed is Wyoming Powder River Basin coal. There are seven rows of coal burners with eight "corners" firing twin fireballs, in one combustion chamber (there is no separating wall between the two fireballs.) Switchgrass is fired into one of the fireballs from nozzles in two opposing corners. Although there is no separating wall between the two fireballs, the gases remain fairly segregated so some comparisons can be made between the two fireballs during co-firing. The boiler is equipped with a hot-side electrostatic precipitator and the fly ash is currently sold for a variety of uses, including concrete manufacturing. During co-fire testing the fly ash needed to be sold for lower-value uses because any contamination with switchgrass ash made it unusable for concrete production, by definition.

Samples collected during testing included the switchgrass and coal fuel, the bottom ash, economizer ash and fly ash. Economizer ash and fly ash samples were taken from opposite sides of the boiler for comparison and baseline sampling burning only coal was conducted at various times during the test period. Oxygen, carbon monoxide, carbon dioxide and nitrous oxide readings were taken during selected test periods and an online continuous emissions monitoring system recorded the opacity, nitrous oxide and sulfur emissions.

The switchgrass feed handling equipment consisted of a bale-breaker, followed with course grinding of the switchgrass to a minus one inch particle size (2.5 cm), after which the material was conveyed pneumatically through two separate transport lines to the two burner nozzles. Several improvements were made to the initial feed handling design to minimize dust levels and increase equipment capacities.

The results of the test campaign will be summarized, including lessons learned about material handling. Emissions and performance data for the co-fire period will be presented along with our conclusions and plans for future testing.